21.41 OUTPUT

OUTPUT allows you to specify the data that will be stored in standard structure format files.

Syntax

```
OUTPUT <parameters>
```

Parameter	Type	Default	Units
ANGLE	Logical	False	
AREA	Logical	False	
BAND.PARAM	Logical	False	
BAND.TEMP	Logical	false	
CHARGE	Logical	False	
CON.BAND	Logical	False	
CONTACT	Integer		
D.BBT	Logical	False	
DELTAV	Real	0.1	
DEVDEG	Logical	False	
E.FIELD	Logical	True	
E.LINES	Logical	False	
E.MOBILITY	Logical	False	
E.TEMP	Logical	True	
E.VELOCITY	Logical	False	
EFIELD	Logical	True	
EIGENS	Integer	5	
ESIZEOUT.NEGF	Real	500	
EX.FIELD	Logical	True	
EX.VELOCITY	Logical	False	
EY.FIELD	Logical	True	
EY.VELOCITY	Logical	False	
EZ.FIELD	Logical	True	
EZ.VELOCITY	Logical	False	
FLOWLINES	Logical	False	

Parameter	Type	Default	Units
H.MOBILITY	Logical	False	
H.TEMP	Logical	True	
H.VELOCITY	Logical	False	
HCTE.JOULE	Logical	False	
HEI	Logical	False	
HHI	Logical	False	
HX.VELOCITY	Logical	False	
HY.VELOCITY	Logical	False	
HZ.VELOCITY	Logical	False	
IMPACT	Logical	True	
INV.AREA	Logical	False	
INV.ANGLE	Logical	False	
INAME	Character		
J.CONDUC	Logical	True	
J.DISP	Logical	False	
J.DRIFT	Logical	False	
J.DIFFUSION	Logical	False	
J.ELECTRON	Logical	True	
J.HOLE	Logical	True	
J.TOTAL	Logical	True	
JX.CONDUC	Logical	False	
JX.ELECTRON	Logical	True	
JX.HOLE	Logical	True	
JX.TOTAL	Logical	True	
JY.CONDUC	Logical	False	
JY.ELECTRON	Logical	True	
JY.HOLE	Logical	True	
JY.TOTAL	Logical	True	
JZ.CONDUC	Logical	True	

Parameter	Type	Default	Units
JZ.ELECTRON	Logical	True	
JZ.HOLE	Logical	True	
JZ.TOTAL	Logical	True	
KSN	Logical	False	
KSP	Logical	False	
L.TEMPER	Logical	True	
LRATIO	Real	1.0	
MINSET	Logical	False	
N.LINES	Integer	20	
NLTAT.GAMMA	Logical	False	
NOISE	Logical	False	
NOISE.IMP	Logical	False	
NOISE.ALL	Logical	False	
OPT.INTENS	Logical	False	
OX.CHARGE	Logical	False	
OLD.AVG	Logical	True	
P.QUANTUM	Logical	False	
PERMITTIVITY	Logical	False	
PHOTOGEN	Logical	True	
POLAR.CHARGE	Logical	False	
QFN	Logical	True	
QFP	Logical	True	
QSS	Logical	False	
QTUNN.BBT	Logical	False	
QTUNN.EL	Logical	False	
QTUNN.HO	Logical	False	
RECOMB	Logical	True	
SCHOTTKY	Logical	False	
SONOS.RATES	Logical	False	

Parameter	Type	Default	Units
T.QUANTUM	Logical	False	
TAURN	Logical	False	
TAURP	Logical	False	
TOT.DOPING	Logical	False	
TRAPS	Logical	True	
TRAPS.FT	Logical	False	
U.AUGER	Logical	False	
U.BBT	Logical	False	
U.LANGEVIN	Logical	False	
U.RADIATIVE	Logical	False	
U.SRH	Logical	False	
U.TRANTRAP	Logical	False	
U.TRAP	Logical	False	
VAL.BAND	Logical	False	
VECTORS	Logical	False	
X.COMP	Logical	True	
Y.COMP	Logical	True	

Description

BAND.PARAM	Specifies that the band parameters (Eg, ni, Nc, Nv, and χ) are included in the standard structure file.
BAND.TEMP	Outputs the following temperature dependent band parameters. • Sqrt(electron concentration * hole concentration) (cm^{-3}) • Conduction band effective density of states (cm^{-3}) • Valence band effective density of states (cm^{-3}) • Energy band gap (eV) • Conduction Band Energy (eV) • Valence Band Energy (eV)
D.BBT	Specifies that the D factor from the BBT.HURKX model will be included in the standard structure file.
CHARGE	Specifies that the net charge will be included in the standard structure file.

CON.BAND	Specifies that the conduction band edge will be included in the standard structure file.
DEVDEG	Causes the distribution of acceptor/donor like traps on the interface, hot electron/hole current density on the interface, and trapped electron/holes to be written to the structure file.
E.FIELD or **EFIELD**	Specifies that total electric field will be included in the standard structure file.
E.LINES	Specifies the electric field lines will be included in the standard structure file.
E.MOBILITY	Specifies that electron mobility will be included in the standard structure file.
E.TEMP	Specifies that the electron temperature will be included in the standard structure file.
E.VELOCITY	Specifies that the total electron velocity will be included in the standard structure file.
EIGENS	Specifies the maximum number of eigen energies and eigen functions to be written to the structure file from a Poisson- Schrodinger solution.
ESIZEOUT.NEGF	Sets the number of energy grid points in the output file where transmission, DOS, current and carrier densities versus energy are stored.
EX.FIELD	Specifies that the x-component of electric field will be included in the standard structure file.
EX.VELOCITY	Specifies that the x-component of electron velocity will be included in the standard structure file.
EY.FIELD	Specifies that the y-component of electric field will be included in the standard structure file.
EY.VELOCITY	Specifies that the y-component of electron velocity will be included in the standard structure file.
EZ.FIELD	Specifies that the z-component of the electric field will be included in the standard structure file.
EZ.VELOCITY	Specifies that the z-component of the electron velocity will be included in the standard structure file.
FLOWLINES	Specifies that the current flowlines will be included in the standard structure file.
H.MOBILITY	Specifies that hole mobility will be included in the standard structure file.
H.TEMP	Specifies that the hole temperature will be included in the standard structure file.
H.VELOCITY	Specifies that the total hole velocity will be included in the standard structure file.
HCTE.JOULE	Specifies that the volumetrically averaged Joule heating will be included in the standard structure file.

HEI	Specifies that the hot electron current density will be included in the standard structure file.
HHI	Specifies that the hot hole current density will be included in the standard structure file.
HX.VELOCITY	Specifies that the x-component of hole velocity will be included in the standard structure file.
HY.VELOCITY	Specifies that the y-component of hole velocity will be included in the standard structure file.
HZ.VELOCITY	Specifies that the z-component of the hole velocity will be included in the standard structure file.
IMPACT	Specifies that the impact ionization rate will be included in the standard structure file.
J.CONDUC	Specifies that the total conduction current density will be included in the standard structure file.
J.DISP	Specifies that the total displacement current density will be included in the standard structure file.
J.ELECTRON	Specifies that the total electron current density will be included in the standard structure file.
J.HOLE	Specifies that the total hole current density will be included in the standard structure file.
J.TOTAL	Specifies that the total current density will be included in the standard structure file.
JX.CONDUC	Specifies that the x-component of the total conduction current density will be included in the standard structure file.
J.DRIFT	Specifies that the drift current density will be included in the standard structure file.
J.DIFFUSION	Specifies that diffusion current density will be included in the standard structure file.
JX.ELECTRON	Specifies that the x-component of electron current density will be included in the standard structure file.
JX.HOLE	Specifies that the x-component of hole current density will be included in the standard structure file.
JX.TOTAL	Specifies that the x-component of total current density will be included in the standard structure file.
JY.CONDUC	Specifies that the y-component of the total conduction current density will be included in the standard structure file.
JY.ELECTRON	Specifies that the y-component of electron current density will be included in the standard structure file.

JY.HOLE	Specifies that the y-component of hole current density will be included in the standard structure file.
JY.TOTAL	Specifies that the y-component of total current density will be included in the standard structure file.
JZ.CONDUC	Specifies that the z-component of the conduction current density will be included in the standard structure file.
JZ.ELECTRON	Specifies that the z-component of the electron current density will be included in the standard structure file.
JZ.HOLE	Specifies that the z-component of the hole current density will be included in the standard structure file.
JZ.TOTAL	Specifies that the z-component of the total current density will be included in the standard structure file.
KSN	Specifies that electron Scattering Law Exponent is to be written to any saved structure file.
KSP	Specifies that hole Scattering Law Exponent is to be written to any saved structure file.
L.TEMPER	Specifies that lattice temperature will be included in the standard structure file.
MINSET	This is the minimum set of data (potential, carrier concentration, and electric field) that will be included in the standard structure file.
NLTAT.GAMMA	Specifies that the Nonlocal trap-assisted-tunneling Gamma factors are written to any saved structure file. The values written have been interpolated onto the device mesh.
OPT.INTENS	Specifies that optical intensity is included in the standard structure file.
OX.CHARGE	Specifies that fixed oxide charge is include in the standard structure file.
P.QUANTUM	Specifies that the Bohm quantum potential is included in the solution file.
PERMITTIVITY	Specifies the dielectric permittivity is saved.
PHOTOGEN	Specifies that the photogeneration rate will be included in the standard structure file.
POLAR.CHARGE	Specifies that polarization charge will be included in the structure file.
QFN	Specifies that the electron quasi-fermi level will be included in the standard structure file.
QFP	Specifies that the hole quasi-fermi level will be included in the standard structure file.
QSS	Specifies that the surface charge will be included in the standard structure file.
QTUNN.BBT	Specifies that the direct quantum tunneling band-to-band current density at each interface node is written to any saved structure file.

QTUNN.EL	Specifies that the direct quantum tunneling electron current density at each interface node is written to any saved structure file.
QTUNN.HO	Specifies that the direct quantum tunneling hole current density at each interface node is written to any saved structure file.
RECOMB	Specifies that the recombination rate will be included in the standard structure file.
SCHOTTKY	Specifies that recombination velocities and barrier lowering will be included in the standard structure file.
SONOS.RATES	This causes the output of four quantities to the structure file. These are the Generation and Recombination rates for the trapped electron states and the trapped hole states in the DYNSAONOS model. This requires the DYNASONOS or BESONOS models.
T.QUANTUM	Specifies that quantum temperatture from the density gradient model is included in the solution file.
TAURN	Specifies that electron relaxation times are to be written to any saved structure file.
TAURP	Specifies that hole relaxation times are to be written to any saved structure file.
TOT.DOPING	Specifies that total doping will be included in the standard structure file.
TRAPS	Specifies that trap density information will be included in the standard structure file.
TRAPS.FT	Specifies that the trap probability of occupation will be included in the standard structure file.
U.AUGER	Specifies that the Auger component of recombination is to be written to solution files.
U.BBT	Specifies that the band to band tunneling rate will be included in the standard structure file.
U.LANGEVIN	Specifies that the Langevin recombination rate will be included in the standard structure file.
U.RADIATIVE	Specifies that the radiative component of recombination is to be written to solution files.
U.SRH	Specifies that the SRH component of recombination is to be written to solution files.
U.TRANTRAP	Specifies that both electron recombination rate and the hole recombination rate into transient traps will be included in the SILVACO standard structure file.
U.TRAP	Outputs the reaction rates of the quantities specified in the REACTION statements. The quantities are output in units of cm^{-3} s^{-1} and a positive value means that the quantity is consumed by the reaction. For electrons and holes, this is the same as a recombination rate.

VAL.BAND	Specifies that the valence band edge will be included in the standard structure file.
VECTORS	Specifies that only vector components will be included in the standard structure file.
X.COMP	Specifies that the composition fraction, x , is to be written to solution files.
Y.COMP	Specifies that the composition fraction, y, is to be written to solution files.

Ionization Integral Parameters

INAME	Specifies the name of a contact for which electric field lines are calculated.
CONTACT	Specifies a contact number for which electric field lines are calculated.
LRATIO	Specifies the spacing ratio between adjacent electric field lines. Defaults to 1.0 for uniform spacing.
N.LINES	Specifies the number of electric field lines.
DELTAV	Since the electric field is near zero at the contact, the electric field line calculations begin at a distance from the contact at which the contact voltage has changed by DELTAV. Defaults to 0.1 V.

Note: See Section 21.55 "SOLVE" and the on-line examples for instructions on using ionization integrals.

NOISE Parameters

NOISE	Selects the total local noise source for output.
NOISE.IMP	Selects the impedance fields for output.
NOISE.ALL	Selects everything for output. Currently, the local noise source, the impedance fields, the short-circuit current Green's function, the individual microscopic noise sources, and the individual local noise sources.

Averaging Parameters for Vector Quantities

OLD.AVG	Specifies that the current and field quantities will be averaged using an older algorithm (from version 3.0.0.R and back). By default the new method is used.
ANGLE	Specifies that averaging of current and fields will be weighted by the size of the angle of triangles intersecting at the node.
INV.ANGLE	Specifies that averaging of current and fields will be weighted by the inverse of the size of the angle of triangles intersecting at the node.
AREA	Specifies that averaging of current and fields will be weighted by the areas of triangles intersecting at the node.
INV.AREA	Specifies that averaging of current and fields will be weighted by the inverse of areas of triangles intersecting at the node.

Note: Certain quantities that can be output into the structure file and subsequently displayed using TONYPLOT need special mention. These quantities are evaluated within ATLAS along the links between grid points. They are represented in the structure file at the grid points themselves. As such these quantities are subject to averaging. In particular, electric field and currents are averaged so as to take into account the vector nature of these values. Mobility is simply summed up over all the links surrounding the grid point and divided by the total number of links. Carrier velocities are derived by dividing the averaged current by the carrier density at the grid point and the fundamental electron charge, q.

An Example of Combining OUTPUT with SOLVE and SAVE

The OUTPUT statement is often used in conjunction with the SAVE statement. The following statement lines specify that current flowlines and electron velocity components are saved in all subsequent standard structure solution files.

```
OUTPUT FLOWLINES EX.VELO EY.VELO

SOLVE  PREVIOUS V5=2 OUTF=data1.str MASTER

SAVE  OUTF=data2.str
```